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09/594,905	06/15/2000	Emilio Rodriguez Cabeo	A33169 PCT USA	9388

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EXAMINER	
PADGETT, MARIANNE L	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/594,905	Applicant(s) Cabeo et al
	Examiner M.L. Padgett	Group Art Unit 1762

—Th MAILING DATE of this communication appears on the cover sheet beneath the correspondence address—

P riod for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

☒ Responsive to communication(s) filed on 10/7/02.

☒ This action is FINAL.

☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

☒ Claim(s) 1-29 is/are pending in the application.

Of the above claim(s) _____ is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) 1-29 is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claim(s) _____ are subject to restriction or election requirement

Application Papers

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Pri rity under 35 U.S.C. § 119 (a)-(d)

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119 (a)-(d).

☐ All ☐ Some* ☐ None of the:

☐ Certified copies of the priority documents have been received.

☐ Certified copies of the priority documents have been received in Application No. _____.

☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a))

*Certified copies not received: _____.

Attachment(s)

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). _____

☐ Interview Summary, PTO-413

☐ Notice of Ref rence(s) Cited, PTO-892

☐ Notice of Informal Pat nt Application, PTO-152

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Other _____

Office Action Summary

1. Claims 1-29 are objected to or rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In the last line of claim 1 "a boride layer" is objected to a using the incorrect article for a limitation that was previously introduced in line 1. Also, because this boride layer produced in the body of the claim fails to have clear antecedence form the preamble, the body is still not commensurate in scope therewith, as "a surface" introduced in the preamble lacks a clear relationship to the layer produced in the body of the claims.

In claims 2 and 3 "said step of" is objected to since the "step" phrasology was never introduced in claim 1, so has no antecedent basis.

In claim 4, (line 5 marked up version) "a glow discharge" is objected to as lacking a clear relationship to the identical term previously introduced in the independent claim 1. Also, in claim 4, there are 3 different temperatures introduced: "a select treatment temperature" which is used during the "first stage" during layer production; and 2 others ambiguously claimed with "maintaining the gas mixture at a higher temperature then a previous temperature during in a second stage" (emphasis added). While the use of second stage implies it is after the first, the claim language does not necessitate this, and the 2nd stage has no necessary or claimed purpose. The boride layer need not be present or effected. Is the higher temperature or the previous temperature "during in a second stage"? And previous to what? Previous could be before the gas mixture was even input into the reactor, such as at room temperature when in storage, or the like! While claims 7, 9 and 10 are similar to claim 4, they do no have these same problems, but if "previous temperature" is intended to be the selected treatment temperature with the 2nd

following the 1st stage, then there is no clear difference between claims 4 and 7. If not, it can merely read on heating up the gas mixture or cooling it down, anytime before or after the "first stage", since the previous temperature can be unheated/room temperature. Although not a formal error, applicant may wish to note that since the "second stage" in claim 7, 9 or 10 has no particular purpose and only relates to the temperature of the gas mixture, it has no particular effect on the boride layer which need not to be present .

Note in claims 4, 7, 9 and 10, while not formally incorrect, since there are no halogens ever necessarily present in the gas mixture (or the surface), there is potentially no possibility of forming halogenides in the first place, hence nothing to be necessarily be prevented, so no limit in actual temperatures that maybe employed for the "select...temperature". Note that none of the dependant claims with halide precursors depend from these claims.

The amendments in claim 1 are sufficient to clarify the claimed process, however note that "relation of..."(3 lines from the end, marked up copy) must be considered to be extremely broad, encompassing any relationship that can have some sort of values, such as proportions, charge, distribution, existence, etc. If applicants intend some particular relationship, such as proportioned amounts, etc., they should consider claiming them explicitly. Also, see claim 14; what does "is set in relation to..." encompass? Are the specific amounts then required to remain invariant; or the proportions in the plasma with respect to each other to be maintained; or is "the determined amount of the excited boron-releasing gas" set in a relationship that just requires a minimum or maximum amount, but thus is not determinably different from the independent claims' options?

The pressures claimed 22-23 remain unexaminable, as applicant's comments on pg. 6 of heir 10/7/02 response that " 'hPA' is a conventional unit of measure used in a atmospheric pressure measurements" does absolutely nothing to answer the questions posed by the examiner or provide a definition. Also, the claimed units are "hPa" not "hPA". To reiterate, in claims 22 and 23, while the meaning of the units of Pa, mPa or KPa, nPa where Pa= Pascals and m=milli, k= kilo, n=nano would be understood, the examiner is unfamiliar with the units "hPa". What does the "h" stand for? Hepta (7 items decimal places bigger or smaller), or is it a typographical error (applicants have effectively denied the possibility of a topographical error)? It was noted that the same units are disclosed in the specification on page 7, hence applicant should be same to provide clear support for any amendment that changes the unit symbol used. However, if "Pa" is really intended as stated on pg. 6 of the response, then a prior art definition with conversion relationships for more commonly used units must be provided to remove this rejection. Neither the units "hPa" nor "hPA" are listed in any conversion tables or unit appendixes available to the examiner.

Claim 27, still does not contain any positive limitation that a noble gas is necessarily present, since claims 26 include zero % (up to) noble gas, thus no noble gas or Ar need be employed (its optional). Yes, the noble gas might be there at 20%, but as "up to" includes zero, none need be present so it is not positively claimed.

Claims 5 and 6 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. It is unclear, how the scope of claims and 6, are

intended to differ from that of claims 2 and 3, respectively. The dependence is the same, and the minor differences in the phrasing do not appear to provide any differences in meaning. Note that since claim 1 already uses "comprising" (line 2), its addition to claims 2 and 3, does not differentiate from claims 5 and 6, since additional generation means are also not excluded there due to the independent claim language.

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-11, and 13-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hunger et al (Canadian), as applied in paper #5.

The Canadian patent to Hunger et al teaches depositing boride layers via a pulsed plasma, having a gas mixture of a boron trihalide, such as BCl_3 or BF_3 at 0.1 to 30 vol. %, mixed with H_2 (20-90%) vol.) and optionally containing argon (pg. 3, line 5, Ar is not necessarily by required as pg. 8 of applicants' response implies). Useful pressures are taught to be 1-10 mbar (i.e. 0.1-1 kPa). The examples teach use of D.C. glow discharge plasma with a constant pulse frequency of 4 kHz, therefore assuming that one cycle= one pulse period, the corresponding pulse period is 250 μsec. See the abstract, page 3 and examples 1-2 (page 5 and 6).

10^2-10^3 Pa

A useful pulsed plasma apparatus is also described on page 5, which has a heatable reaction chamber; a pump system for evacuating the chamber and setting pressures, a gas supply unit for mixing and metering gas mixtures; a pulsed plasma generator (which with the examples 1-2 disclose is D.C., so inherently has pulsed D.C. voltage) which is noted to have means for a

wide range of pulse frequencies or pulse widths; and systems for neutralizing and disposing of the gas (equivalent to purification), and for controlling and maintaining the operating parameters.

Note the independent claims (and all claims except 15 and 24-29) is independent of any specific reactive gas mixture, hence also of any specific exited B-releasing gas products. Also, anytime one maintains use of a specific gas mixture under stable or continuously maintained plasma conditions and/or parameters, one will inherently produce some minimum and some maximum value of each plasma species created. This will be true whether or not one ever specifically measures the exact amount, concentration or distribution of any species in the plasma during the deposition, or layer formation. Hunger et al's parametes are selected to deposit a boride layer, hence the minimum and maximum values of various B-releasing species are effective therefore. Note that the claims as written, never require any actual control or feedback or use of "determining the amount", since the production parameters are selected according to some unspecified but independently derived (as claimed) minimum and/or maximum values of various descriptions.

As noted previously, the "determining the amount... excited...product", can be done at any time, in anyway, with any degree of precision, and it would have been obvious for one of ordinary skill to note that the plasma is or is not present, hence reaction products for reactions as discussed on page 4 of Hunger (pg. 6 of FAX), have or have not been formed (i.e. the amount is greater than zero). Furthermore, Hunger et al teach monitoring and controlling their reaction parameters to control and the monitor the course of the reaction (pg.5, line 16-19), hence would have obviously selected parameters which produce suitable reactive species in the plasma, that

enable the taught deposition, by taught excited species, because such would have been required to produce an efficient deposition process. Note that monitoring and controlling the course of the reaction is inclusive of either or both plasma gas conditions or species, and deposition characteristics. The phrasing "course of the process" strongly implies plasma conditions and characteristics. Note that simply maintaining plasma conditions within a particular or optimum range, will inherently have minimum and maximum values of excited species of the metered reaction mixture.

On page 4 (top), Hunger et al recognize that gas composition and reaction conditions (i.e. parameters) are interrelated. On page 1-2 (bottom+top) Hunger the al recognize problems caused by halides (HCl, $FeCl_2$) formulation when BCl_3 was the source gas, but the bottom of pg. 2 teaches that their process "does not suffer from above mentioned disadvantages", hence process parameters must have been employed that prevent the halogenate formation problem, including temperature. Note as lines 15-25 of p.2, teach essentially that it is known in the art that the halogenides are not a problem, after an imperiaeable ? impermeable ? boride layer is formed, so it would have been obvious from prior art knowledge to one of ordinary skill that conditions could have been relaxed after such an occurrence, but it is unknown whether or not such is the intent of applicants' claims 4, 7 and 9-10, with respect to the undefined "second stage".

While the pulse period of Hunger et al's example is 250 μs, not significantly higher than the claimed 230 μsec in applicants' claimed range of less than that value. Considering that Hunger et al teach a wide range of pulse frequencies and widths, it would have been obvious to one of ordinary skill in the art to use the exemplary frequency as a guide line, and perform routine experimentation to optimize according to reactor, gases employed, desired end results,

etc., hence the values would have been expected to be overlapping with claimed ranges. Note as Hunger uses pulsed D.C., there are inherently pause durations as well as pulse durations, and the taught wide range of pulse widths, would have been expected to include those around 1:1 or insignificantly different therefrom, such as the claimed 1.1 to 1. Furthermore, as the plasma can be used to heat the substrate (Ex. 2), and the pulse width controls the power density to cause the heating, it would have been obvious to one of ordinary skill in the art to determine such required pulse width, hence, also pauses, via routine experimentation.

The meaning applicant's pressure units "hPa" remains unknown, however if it is a typographical error for kPa, Hunger et al's values overlap with applicant's claimed range, and one of ordinary skill in the art might conclude that such was probably intended. If "hPa" is not an error as implied by an applicant's response (pg. 6), claims 22-23 must be considered unexaminable until properly defined, or fatally defective if "hPa" cannot be acceptably defined.

Hunger et al does not discuss what voltage ranges are useful in the process, however it would have been obvious for one of ordinary skill in the art to determine such via routine experimentation, since voltage is a necessary component of the process. Hunger et al obviously expects one of ordinary skill in the art to be able to readily determine appropriate voltages, since they do not specify particular values.

4. Claims 2, 5, 11, 13, 14 and16-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hunger et al as applied to claims
1-11 and 13-29 above, and further in view of Oppel et al.

The Canadian patent to Oppel et al is cumulative to the above Hunger et al rejection, noting that its discussion of vapor and lower threshold values for parameters used in a pulsed

plasma process, may have some relationship to applicants' intended purpose behind the "minimum..." and "maximum value", although that can be broadly interrupted. Also, Oppel et al illustrate a means for using pulse-pause ratios in regulating temperature, which is related to Hunger et al's Ex. 2 process. It would have been obvious to one of ordinary skill in the art to apply the teachings of Oppel et al concerning temperature control, and pulse-pause ratio in the plasma of Hunger et al, in order to achieve the taught heating via glow discharge plasma in a controlled manner, as Hunger et al teach monitoring and control generally, with Oppel et al providing a specific applicable means, which is consistent with Hunger et al's process.

5. Claims 1-11, 13-16, 18-21 & 24-29 are rejected under 35 U.S.C. 102(b) as being anticipated by Hou.

Hou teaches pulsed RF plasma, where a variable D.C. power supply is used to supply voltage (0-600 volts) to create the pulses. The frequencies, i.e. pulse repetition rate maybe from 0.1 to 20 kHz, which produces pulse periods in the claimed range of less than 230 μsec (col. 5, lines 1-15 and 46-75, the gas used are a mixture of hydrogen and a boron compound, such as boron trihalides (BF_3, etc...), alkyl borates ($B(OR)_3$), diborane (B_2H_6), etc. (col. 3, line 50; col. 4, line 20), where relative quantities boron compound to hydrogen are determined from the molar ratio of B to H of about 1:2 to about 1:5, hence BF_3 to H_2 volume ratios, assuming ideal gas behavior, would be $1BF_3$:2 ($1/2H_2$)=1:1 to $1BF_3$:5 ($1/2H_2$)=1:2.5 or 50% BF_3 to about 28% BF_3.

Hou teaches variable on and off times/durations for the pulses, noting that heat generation can be control through variation of the pulse repetition rates, the pulse width or duration, or both (col. 6, lines 28-57). A thermocouple is used to measure temperature shown on meter 25, so that the expectation, hence temperature of the process can be controlled via the pulse characteristics

(col. 6, lines 58-73). On col. 7, lines 1-10, Hou gives repetition rates of about 0.5-100 kHz (i.e., pulses of 2000 μsec to 100 μsec) and pulse widths of 0.1 to 1000 μsec, therefore the pause durations would correspond to the difference, so pulse duration to pause duration is 1:1 or less.

Note example 1 indicates that the input rate of H_2 and B-containing gas individually controlled, hence means to do so are inherently suggested. In lines 59-69 of col. 7 (Ex. 1, end), Hou states, "A boron-hydrogen excited gas species or "plasma" was indicated by a visible glow within coating zone 20, and boron began depositing on the substrate", thus Hou inherently visually determined that sufficient amounts of excited B-containing gas were present in the plasma for deposition to occur. Discussion concerning plasma maintenance, and the inherency of some maximum and minimum values of excited species for parameters selected to maintain the plasma, as presented in section 3 above, are also applicable to Hou. While Hunger et al's control and monitoring teachings maybe more germane to applicants' intent, Hou is sufficient given the present cryptic language.

Hou's teachings suggest a ratio of voltage pulse duration to subsequent pause of about 50:50 or 1:1, which while not the same as greater than 1.1:1, is insignificantly different, because one of ordinary skill in the art would find it obvious to include numbers around the 1:1 ratio (i.e., the 1.1:1) in the useable ratios calculated or determined from Hou's disclosure, because they are within the bounds that the significant figures would include with the "about" phasing of taught parameters.

Hou does not teach a two stage process, where a lower then a higher temperature is used to deposit their boride layer, however in col. 5, lines 28-42, it is noted that the coating zone may assume a slightly more elevated temperature than the gaseous atmosphere, because of

recombinate reaction occurring at the surface...". Therefore, one of ordinary skill in the art would recognize that since the substrate proceeds continually through the reaction chamber, its temperature, and that of the gas immediately surrounding it would have been higher at the end of the reaction chamber, than at the beginning. As the temperature of the chamber is controlled, this expected variation during the transverse of the length of the chamber would have been expected to be maintained. Note that since there is no claimed specific degree of temperature variation, non-relative or necessary effects claimed, this is sufficient to read on the claimed language.

6. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hunger et al (Canada) or Hou as applied to claims 1-11 and13-29 as appropiate above, and further in view of Walthers or Kohler et al.

While the above references discuss monitoring or control of various aspects of their plasmas and process, there are no teachings on spectroscopicly determining amounts of B-containing excited species in their plasmas, however it is old and well known to monitor plasma species by such means as illustrated in Kohler et al (Figure 1; col. 5, line 51- col. 6, line 15 for pulsed D.C. power supply/voltage) or Walther (abstract; col. 1, lines 24-34 and col. 2, lines 30-59), both of which show spectroscopic analysis of plasma species in pulsed plasma processes, thus it would have been obvious to apply such old and well known techniques in Hunger et al or Hou, in order to provide effective monitoring means, because it is known that such monitoring enables more accurate control, and for optical emission spectroscopy particularly since such means produces no harmful interactions with the plasma.

7. Applicant's arguments filed 10/7/02 as discussed above in context of the rejection, have been fully considered but they are not persuasive.

Would a more active connection between applicant's determining and selecting steps be pertinate to the invention? Can the maximum and minimum values be more explicitly defined? See above.

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action. Any inquiry concerning this communication or earlier communications from the examiner should be directed to M. L. Padgett whose telephone number is (703) 308-2336. The examiner can normally be reached on Monday-Friday from about 8:30 a.m. to 4:30 p.m..

The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 (official); 872-9311 (official); or 308-6078 (unofficial).

Examiner Padgett/ng 01/14/03

January 15, 2003

MARIANNE PADGETT
PRIMARY EXAMINER